



EXAMINATIONS COUNCIL OF ZAMBIA



Examination for School Certificate Ordinary Level

Additional Mathematics

4030/2

Paper 2

Monday

21 NOVEMBER 2022

Additional Materials:

- Answer Booklet
- Silent electronic calculator (non programmable)
- Graph Paper (1 sheet)

Time: 2 hours 30 Minutes

Marks: 100

Instructions to Candidates

- 1 Write the **centre number** and your **examination number** on **every page** of the separate **Answer Booklet** provided.
- 2 There are **twelve** questions in this paper. Answer **all** questions.
- 3 Write your answers in the separate Answer Booklet provided.
- 4 If you use more than one Answer Booklet, fasten the Answer Booklets together.
- 5 Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

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Information for Candidates

- 1 The number of marks is shown in brackets [] at the end of each question or part question.
- 2 **The use of a non programmable electronic calculator is expected, where appropriate.**
- 3 You are reminded of the need for clear presentation in your answers.
- 4 Cell phones are **not allowed** in the examination room.
- 5 **Check the formulae overleaf.**

Mathematical Formulae

1 ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2 SERIES

Arithmetic $S_n = \frac{1}{2}n[2a + (n-1)d]$

Geometric $S_n = \frac{a(1-r^n)}{1-r}$ ($r \neq 1$)

$$S_\infty = \frac{a}{1-r} \text{ for } |r| < 1$$

3 TRIGONOMETRY

Identities

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B.$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B.$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

4 STATISTICS

Mean and standard deviation

Ungrouped data

$$\text{Mean } (\bar{x}) = \frac{\sum x}{n}, \text{SD} = \sqrt{\left\{ \frac{\sum (x - \bar{x})^2}{n} \right\}} = \sqrt{\left\{ \frac{\sum x^2}{n} - (\bar{x})^2 \right\}}$$

Grouped data

$$\text{Mean } (\bar{x}) = \frac{\sum fx}{\sum f}, \text{SD} = \sqrt{\left\{ \frac{\sum f(x - \bar{x})^2}{\sum f} \right\}} = \sqrt{\left\{ \frac{\sum fx^2}{\sum f} - (\bar{x})^2 \right\}}$$

1 Solve the following systems of equations:

$$2x + y - 2z = 9,$$

$$x + y + 2z = 3,$$

$$4x + 2y + z = 13.$$

[6]

2 (a) Find the range of values of x for which $6 + 5x - x^2 < 0$.

[3]

(b) Express $8 - 6x - x^2$ in the form $a - (x + b)^2$, where a and b are constants. Hence, find the maximum value of $8 - 6x - x^2$.

[4]

3 Solve the equations

(a) $5^y = 10,$

[3]

(b) $2\log_2(2x) + 2 = \log_2(2x + 5).$

[4]

4 (a) Find the value of c , given that the expression $4x^3 - cx^2 - x + 2$ is divisible by $(x - 2)$. [3]

(b) Solve the equation $x^3 + 3x^2 - 4x - 12 = 0$. [4]

5 (a) Eleven learners are to be placed in a straight line.

(i) Find the number of ways these learners can be arranged, if there are no restrictions. [2]

(ii) Find the number of ways these learners can be arranged, given that the three youngest are together. [3]

(b) A team of four is to be chosen from 7 girls and 8 boys. In how many ways can the team be chosen if there must be two boys and two girls? [3]

6 (a) (i) Express $3 \cos \theta + \sin \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0^\circ \leq \alpha \leq 90^\circ$. [3]

(ii) Hence, find the maximum value of $3 \cos \theta + \sin \theta$. [1]

(b) Find all the angles between 0° and 360° which satisfy the equation $\sin(\theta + 30^\circ) = 2 \cos \theta$. [4]

- 7 (a) The fourth term and the twenty second term of an arithmetic progression are 4 and 5 respectively. Find the
- (i) first term and the common difference, [3]
 - (ii) fortieth term of the progression. [2]
- (b) The second and fourth terms of a geometric progression are 20 and 12.8 respectively. Given that all the terms are positive, find the sum
- (i) of the first 7 terms, [3]
 - (ii) to infinity of the progression. [1]
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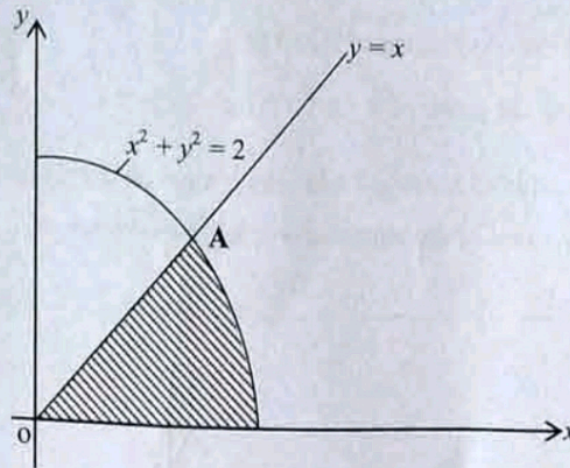
- 8 The table shows the masses of packets taken as samples from machine A and machine B in a manufacturing company.

Machine A mass (g)	296	298	298	299	300	300	301	301	302	305
Machine B mass (g)	292	294	295	298	300	301	303	304	306	307

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- (a) Find the standard deviation of each machine. [7]
 - (b) Which of the two machines is more reliable? Give a reason for your answer. [2]
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- 9 In the following diagram, part of the curve $x^2 + y^2 = 2$ and the line $y = x$ meet at the point A.



Find the

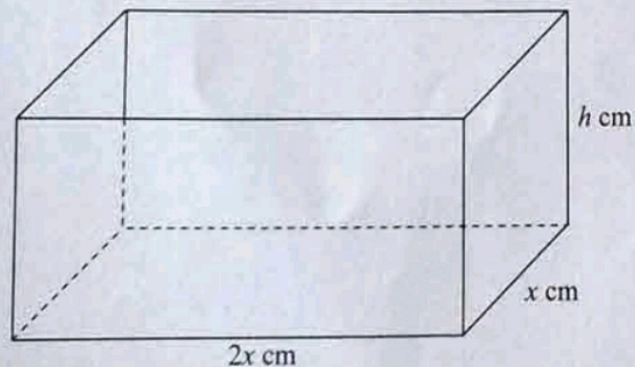
- (a) coordinates of A, [4]
 (b) volume obtained by rotating the shaded region through 360° about the x -axis. [5]

- 10 A particle Q travels in a straight line from a fixed point O, so that its velocity, V m/s is given by $V = 24 - 10t + t^2$, where t is the time in seconds after leaving O. Find the

- (a) values of t at which Q is at instantaneous rest, [4]
 (b) total distance travelled in the first 6 seconds. [6]

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- 11 The diagram shows a cuboid with a base of sides $2x$ cm and x cm.



- (a) Given that the total surface area is 432cm^2 , show that the height h of the cuboid is given by $h = \frac{432 - 4x^2}{6x}$. [3]
 (b) (i) Find the value of x for which the volume of the cuboid, $V\text{cm}^3$, is stationary. [3]
 (ii) Hence, determine the nature of the stationary point. [4]

- 12 (a) The curve $y = e^{2x} - 5$ meets the x -axis at P and the y -axis at Q.
- (i) Find the coordinates of P and Q. [3]
- (ii) Sketch the graph of $y = e^{2x} - 5$ for $-2 \leq x \leq 1$. [3]
- (b) Find the equation of a straight line which must be drawn on the graph of $y = e^{4x}$ to obtain the solution of the equation $x = \ln(\sqrt[4]{6x-5})$. [4]
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